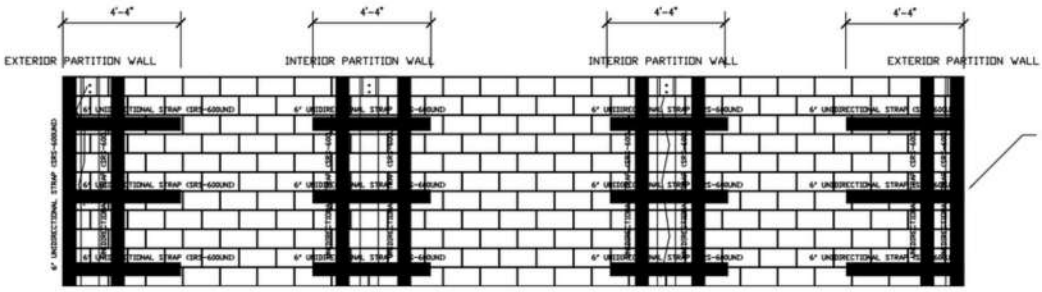
CASE STUDY

CARBON FIBER HURRICANE DAMAGE STRENGTHENING

OUTER BANKS, NORTH CAROLINA

Hurricanes and severe storms can cause extensive damage to properties in high risk areas. This recently completed project on North Carolina's Outer Banks was no exception and shows how carbon fiber can be used to repair and reinforce these damaged structures.

Located in a coastal town vulnerable to hurricane events, a multi-story residential building was severely affected by a Category 4 hurricane. The structure exhibited extensive cracks, spalling, and reinforcement corrosion, compromising its integrity and safety. After being contacted by a local engineering firm, SRS brought together the Structural Engineering and Contracting teams to developed and implement the final solution to restore the buildings structural capacity and mitigating future risk of damage.

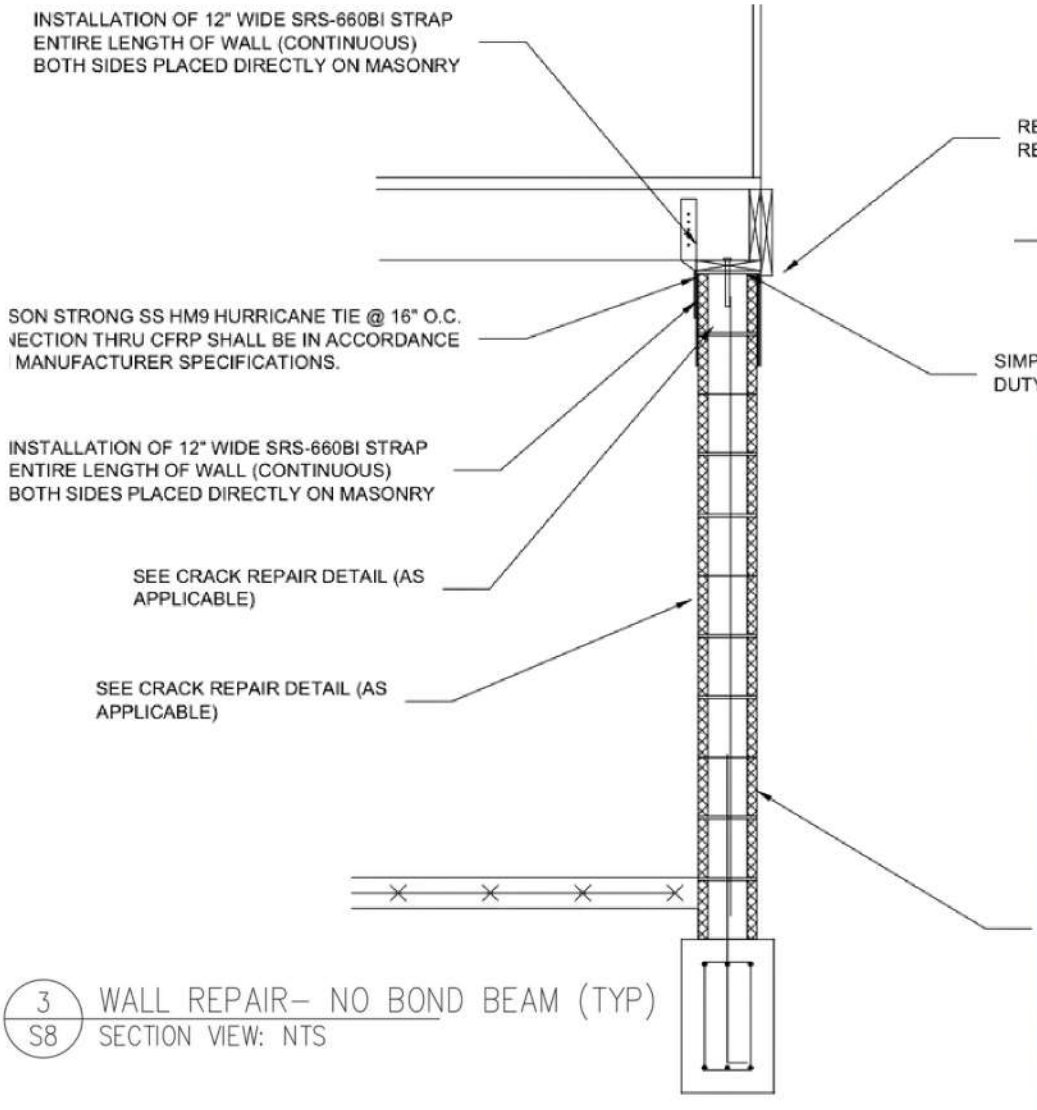


There were several areas where the bond beams and other structural elements needed to be replaced. In addition to these replacements, SRS's carbon fiber strengthening systems were utilized to increase tie down forces, strengthen specific elements, and to restore the capacity in areas where damage and deterioration were present. The benefit of using CFRP in strengthening applications such as this is the enhanced resistance to environmental deterioration.

In coastal regions prone to hurricanes, concrete structures and buildings often face significant damage due to the high winds and storm surge associated with these natural disasters. In recent years, carbon fiber structural strengthening has emerged as an innovative solution to enhance the resilience and durability of these structures.

The damaged areas of the concrete structure were prepared by removing loose or deteriorated concrete, cleaning the surfaces, and roughening the substrate to achieve a suitable bond with the CFRP materials. Any corrosion on the reinforcement was treated and repaired.

The carbon fiber strengthening system, consisting of CFRP fabric impregnated with epoxy resin, was applied to the prepared concrete surfaces and bond beams. The CFRP material was strategically placed along the weakened structural elements, such as bond beams, columns, and walls, to provide additional flexural and shear strength.



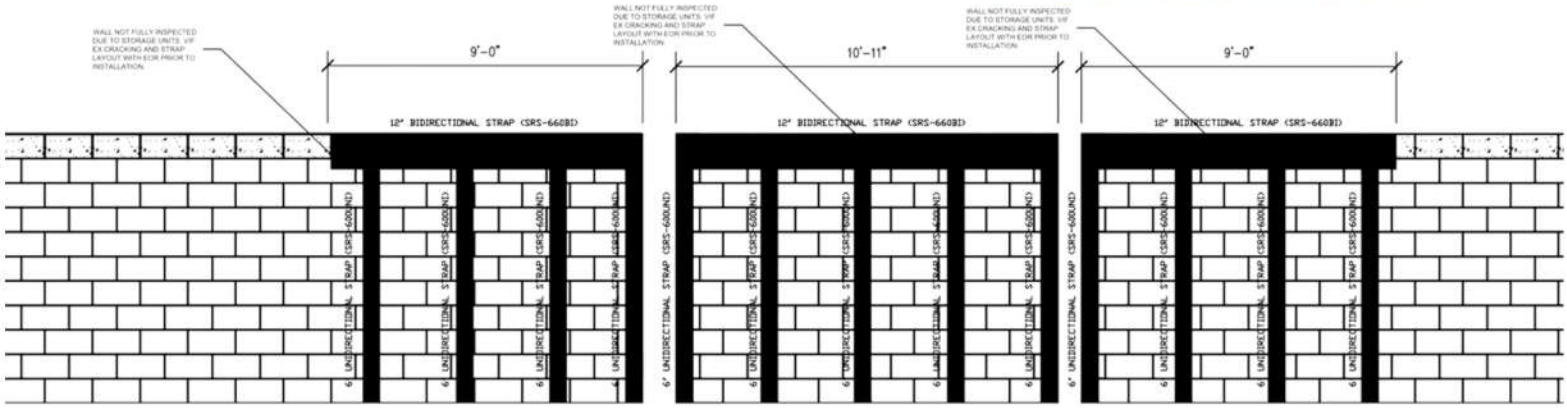
CARBON FIBER STRENGTHENING SYSTEMS

Results and Benefits: The application of carbon fiber structural strengthening yielded several positive outcomes:

a. Enhanced Structural Integrity: The carbon fiber reinforcement significantly increased the flexural and shear capacity of the hurricane-damaged structure. It restored the original strength and integrity of the weakened elements, thereby improving the building's overall stability and load-carrying capacity.

b. Increased Resilience to Hurricane Forces: The strengthened structure exhibited enhanced resistance against hurricane forces, including wind loads and storm surge. The CFRP materials work to distribute the applied forces, minimizing the risk of further damage during future hurricane events.

c. Quick and Efficient Installation: Compared to traditional retrofitting techniques, carbon fiber strengthening offered a faster and more efficient installation process. The lightweight and flexible nature of CFRP materials facilitated ease of handling, reducing construction time and associated costs.



d. Durability and Corrosion Resistance: CFRP materials possess excellent resistance to environmental degradation, including corrosion from saltwater exposure. The carbon fibers are non-metallic and non-corrosive, ensuring long-term durability and minimizing maintenance requirements.

Coastal Construction, United Structural Systems, and a team of structural engineers and specialists successfully completed the retrofitting project using SRS carbon fiber composites, installation techniques, and material specifications, to ensure efficient, effective strengthening results that will last for years to come.

This case study underscores the effectiveness of carbon fiber structural strengthening as a valuable solution for rehabilitating hurricane-damaged coastal concrete structures, providing improved resilience and safeguarding against future natural disasters.